AN ARCHEOLOGICAL SAMPLE OF THE WHITE MOUNTAIN PLANNING UNIT APACHE-SITGREAVES NATIONAL FOREST, ARIZONA

BY

BRUCE R. DONALDSON

MAY 1975

ARCHEOLOGICAL REPORT

USDA FOREST SERVICE
SOUTHWESTERN REGION
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NO. 6

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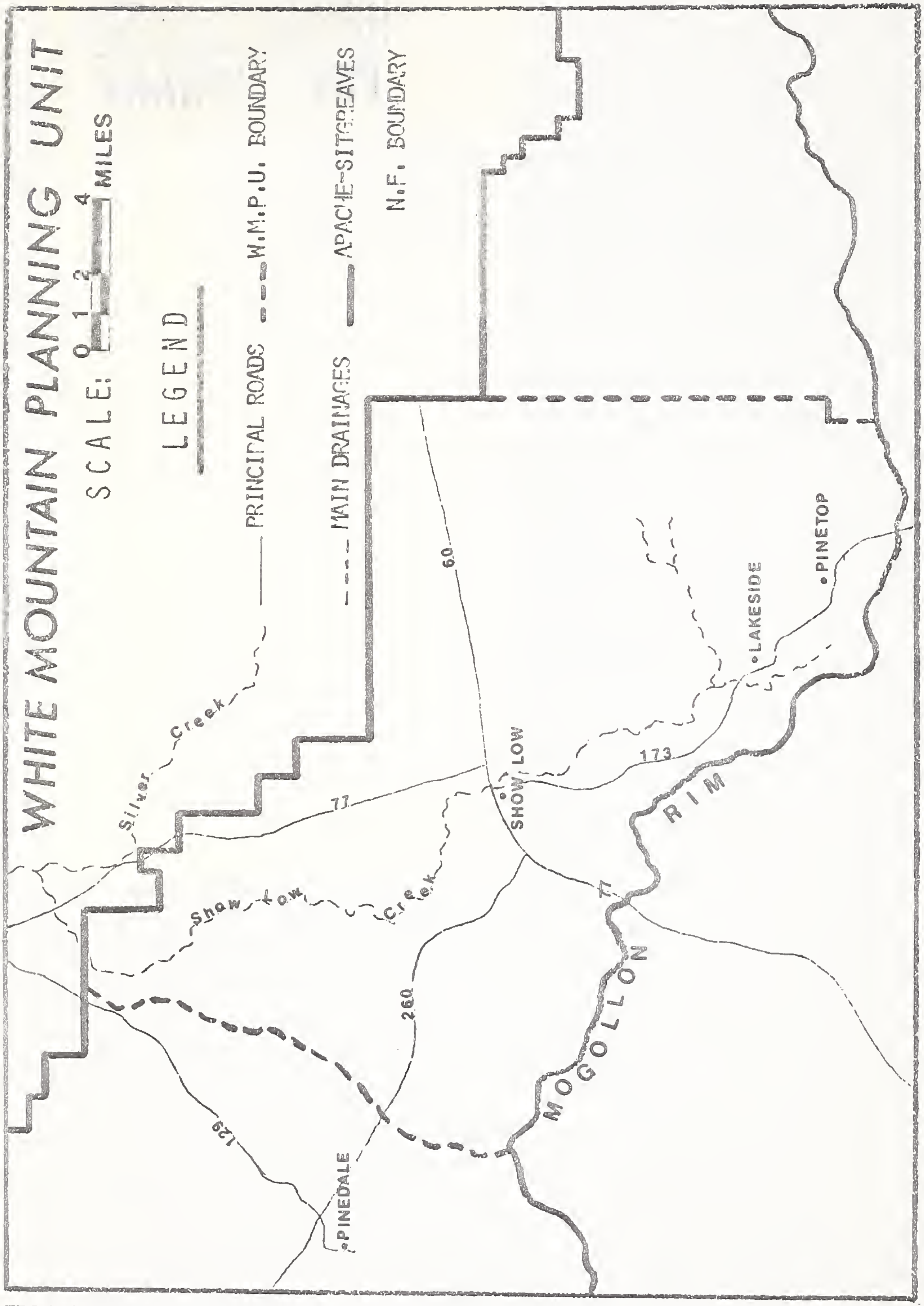

FRONTISPIECE: Map of the Planning Unit.

NOTE

Strategies for assessing cultural values are increasingly important not only to the archeologist but especially for the land manager who faces responsibility for their management. With over 20 million acres of National Forest land in the Southwestern Region, a complete inventory of our cultural resources will require long-term programing. In the meantime development of sampling strategies to aid in current planning is essential if the cultural resource is to be considered in land management decisions. This report represents the first attempt by the Region to sample archeologically a planning unit. We trust it will not be the last attempt, and the foundation supplied by Mr. Donaldson can be used and improved as similar strategies are employed on other planning units Region-wide.

Dee F. Green, Ph.D.
Regional Archeologist
USDA Forest Service

ACKNOWLEDGEMENTS

This note will serve to thank those people whose cooperation has helped make this report possible. The Forest Service personnel at the Supervisor's Office, Apache-Sitgreaves National Forest, Springerville, Arizona--William Edwards, Director of the White Mountain Planning Unit Study; Harold Coley, Arlie Holm, and their colleagues--were instrumental in starting and supporting this study. At the District level, Merrill Richards, Adrian Hill, Tom Chacon, Keith Crumrine, Ben Hansen, and especially, Frank Malone, were unfailing sources of aid and information. Dr. Dee F. Green, Regional Archeologist, was the individual responsible for involving us in the project.

A survey of the scope reported here is not a one-man operation; more than a dozen students from the State University of New York at Binghamton, the University of Michigan, and the University of California at Los Angeles have contributed time, effort, and thought, both in the field and in the laboratory, toward the success of the research. Special appreciation must be accorded Dr. Fred Plog, Department of Anthropology, SUNY-Binghamton, who coordinated and supervised this project from its inception. He and Dr. Margaret L. Weide of the same department both read the report in typescript and followed its progress; they have given of their time freely, offering thoughtful, constructive comments as well as necessary support and encouragement. These two individuals have taught me a great deal, not only about what archeology is, but about what it should be. While the contributions of these many people are gratefully acknowledged, the sole responsibility for the content and conclusions of this report must rest with the author. It should be especially noted that publication of the report by USDA Forest Service does not necessarily constitute support or endorsement by the agency or any of its personnel for the conclusions and recommendations included herein.

As a final acknowledgement, there are two individuals whose support and encouragement are a constant source of inspiration; they have instilled in me an appreciation of nature, of people, and of the world around me. This volume is dedicated, with love and gratitude, to my parents.

B.R.D.
March 1975

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

This report of an archeological reconnaissance undertaken in July and August, 1974, is intended to serve two purposes. First, this report fulfills certain contractual obligations made to the Apache-Sitgreaves National Forest. Secondly, since the recent enactment of the Archeological Conservation Act (P. L. 93-291) means that more studies of this nature will be made in the future, some effort has been made to detail the manner in which our own reconnaissance was operationalized.

The report is subdivided into five sections. The first section on Procedures details our contractural and programmatic objectives, and the strategy, tactics, and tasks that were utilized in meeting these goals. The second section on the Natural Laboratory offers a brief description of the area in eastern Arizona where our fieldwork was undertaken. The next section provides a detailed view of the construction of our research design and the rationale behind the decision-making processes involved. The fourth section outlines the prehistory of the Upper Little Colorado River region, including a preliminary estimation of how the archeology of the Planning Unit fits into this framework. The final section is an impact statement concerning the disturbance and destruction of archeological resources; some recommendations are offered as to how such impact might be mitigated.

PROCEDURES

Objectives

Early in the summer of 1974, the Supervisor's Office, Apache-Sitgreaves National Forest, contracted with Dr. Fred Plog, Chairman, Department of Anthropology, State University of New York-Binghamton and director of the SUNY-B Southwestern Field School, to inventory archeological sites on a portion of the Forest known as the White Mountain Planning Unit. The inventory was one part of a multi-component, long-term project designed to evaluate natural and cultural resources so that optimal utilization of the Forest could be planned (USDA 1972 reports a similar study).

Specifically, the contract covering our portion of the study identifies three long-term goals and a similar number of short-term goals, plus the procedures to be used in attaining the latter, Long-Term Goals. These goals essentially correspond to those of the Chevelon Archological Research Project through which Professor Plog has been pursuing his primary research interests since 1970 (see Plog, Hill, and Read in press). The Project has identified

three major problem foci: (1) The study of variability in the design of ceramic vessels; (2) Man-land relationships concentrating on the issues of (a) soils (Plog 1974a; Palmer n.d.), (b) vegetation (Hoffman n.d.), and (c) water and soil control strategies (Plog and Garrett 1972); and (3) Demography and the evolution of social organization (Plog 1974a and 1974b). In part these goals are in conformity with the general objectives of the Southwestern Anthropological Research Group (Gumerman 1971).

One might question the specification of such problem foci in that these do not seem germane to the primary objectives of the contract work as detailed by the short-term goals. A parallel criticism was voiced by Chenhall (1971) in response to an article by Fritz and Plog (1970) that espoused the conscious development of a formal research design in all aspects of archeology; Chenhall took to task the practicability of such design development in regard to contract salvage work where the lead time between site location and the implementation of heavy equipment work is often too short to set up a formal design for research. Prof. Plog's response (personal communication; see also Watson 1973) is that, while salvage specialists may not know when they may be needed, they nevertheless know that they will be called on and should know approximately where salvage will be needed; thus, research designs can be formulated on a contingency basis, specifying an overarching set of problem foci and the methods needed to handle such problems. The inclusion of such formal, long-term goals in such contract work is necessary. In terms of cost (man-hours as well as dollars and cents), the additional expenditures are minimal in the absolute and nonexistant relative to the knowledge gained. Archeology must move away from the "butterfly-collecting" approach in order to make optimal use of the finite number of prehistoric resources.

Short-Term Goals. In the short run, our research had three major purposes: (1) Initiating an inventory of archeological resources within the White Mountain Planning Unit; (2) Deriving from a sample survey of the area a map of the distribution and density of archeological sites within the Unit; and (3) Estimating the impact on archeological resources of (a) private landownership within the Forest boundaries, and (b) variation in access to areas rich in sites.

The Forest Service, in addition, required that USDA-Forest Service Archeological Site Inventory forms on each site located be filed, and that a report on our investigation, including the site-density map, be submitted to the Supervisor's Office. This volume constitutes that report.

Strategy

Formulation of the survey and sampling designs were the responsibility of Prof. Plog and his staff. These designs and their rationale are presented in full under the section on Research Design. While Prof. Plog oversaw the development of the research

design and coordinated the project, the press of professional obligations did not allow him to direct implementation of the design in the field. Field direction was therefore undertaken by the author, a graduate student at SUNY-B, for the first two stages of the investigation, and by Stephen Plog, a University of Michigan graduate student who directed the third and final stage. (For an explication of the investigative stages, see the subsection on Tactics immediately below.) The field crews were staffed by undergraduates from SUNY-B, the University of Michigan, and the University of California-Los Angeles. These undergraduates were trained in survey techniques during the course of the SUNY-B Southwestern Field School which immediately preceded the Planning Unit study.

Tactics

Our primary investigation consisted of pedestrian survey along transects that were generally either 1 or 1.4 miles in length. Each crew consisted of two people who maintained an ideal distance of 10 meters (almost 12 yards) from each other along the length of the transect; when they reached the end of the transect, they turned 180° and returned on an adjacent course that paralleled the original swath. With each crew member responsible for observing the area some 6 yards to each side of the line he was walking, the transects were thus about 50 yards wide. These procedures were followed for nonrandom as well as random transects in order to make the results of all segments of the survey comparable, increase precision of our site-density estimates, and reduce a possible source of bias in those estimations.

The relatively close spacing of crewmen (cf. Mueller 1974:10 where observers were stationed "50-150 yd apart") also reduced a possible source of bias: that due to observer error. We define a site, at minimum, as five artifacts per square meter. (The exception to this is an isolated ceramic scatter where all sherds obviously come from the same vessel--while not usually given a site designation, such occurrences are nevertheless noted in the field log.) Even sites of minimal dimensions can carry important theoretical implications (Plog 1974a, 1974b), hence our interest in small "limited activity" sites and our desire to locate them.

The strategy adopted called for three explicit stages of our research (see Redman 1973). Stage I, a purely statistical tactic, saw us undertaking the traverse of those transects generated by our compound or hierarchical sampling design. This gave us a preview of the extant ecologic, geologic, and topographical variability of the Planning Unit, as well as a preliminary idea of site incidence in relation to those natural variables.

The second stage involved archeo-statistical tactics. The goal of this stage was to define gradients in the site-density pattern.

Based on the insights gained from Stage I plus information provided by Forest Service personnel, we placed nonrandom transects in areas known or suspected to contain sites. In some cases, most notably that involving the Bagnal Hollow Great Kiva, a preliminary search was made for a particular site and that locus then became the base for generating the nonrandom transects. Other cases involved locating transects in gaps left by the random elements in Stage I, making coverage of the Unit more even. (It should also be noted that essentially nonrandom elements were added to some random transects, usually in order to make locating the end of the transect easier; but in some cases to survey nearby, off-transect areas which seemed likely to contain sites--see Figure 1.) The success of the Stage II tactics in terms of achieving evenness is indicated by the post hoc determination of the percentage point difference statistic which shows that only 5 percent of the transects would need to be moved in order to approximate random sorting between the biotic communities; this amounts to about three transects (see Figure 1 and cf. Figure 2).

Stage III involved intensification of the research. This contained two distinct elements: block or quadrat survey, and intensive artifact collection. Block surveys were undertaken in areas that we knew to contain site clusters, primarily to locate all the sites in that area, and, of slightly less import to the present concern, to identify adaptation patterns and concomitant site-association measures. Sites with relatively heavy artifact concentrations were systematically collected to aid in the design-element analysis focus of our programmatic interests.

Tasks

Field. When a site was located, the crew members would work in conjunction to define the type of site and delimit its boundaries. (If, for instance, a site had structures that were found by following an artifact scatter to its origin, away from the transect, the site was duly recorded as "off-transect;" this, again, an attempt to control unwanted bias while still garnering as much information as possible.) With this accomplished, one crewman would record site information on a standard form, including data on site type, size and description, artifact density, biotic and geomorphologic proveniences, and a scaled sketch-map. Meanwhile, the other crewman would made a surface collection of artifacts, usually working along a line that extended through the area with the densest artifact incidence. Such "collection transects" were made to insure that we would sample the artifactual variability of the site surface. At times this collection transect was widened in order to obtain a sufficient number (ca. 50-100) of diagnostic (i. e., Black-on-White) sherds. Special--Stage III--collections were kept separate from the sample assemblages.

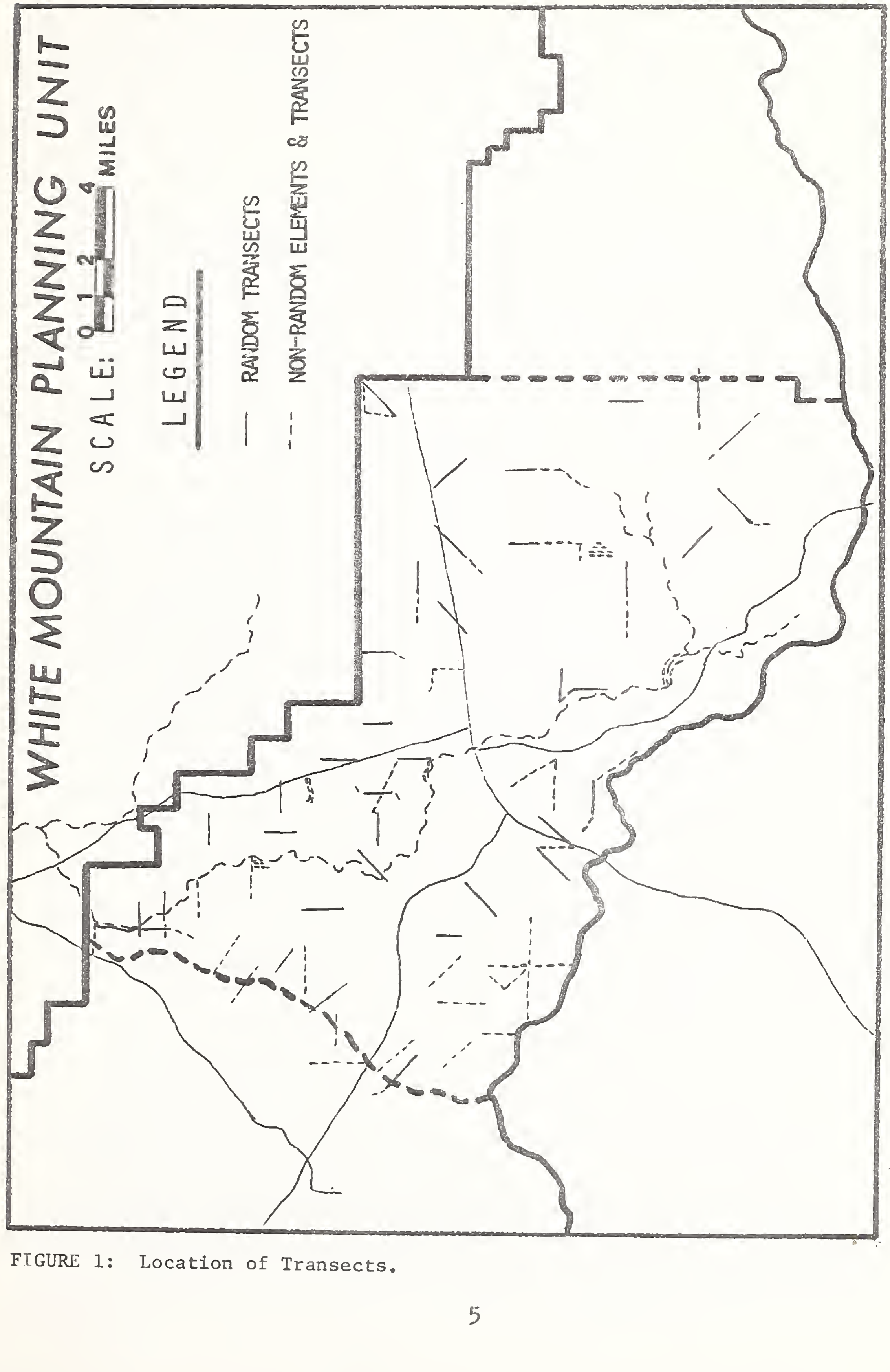

FIGURE 1: Location of Transects.

Laboratory. Every day following fieldwork site forms and field logs were checked; site locations were transferred to the master map; washing, labeling, classification and cataloging of artifacts were done; and the F. S. Inventory forms were completed.

THE NATURAL LABORATORY

The White Mountain Planning Unit is contained within the Apache-Sitgreaves National Forest in the vicinity of the town of Show Low, in eastern Arizona. The Unit encompasses some 226 square miles of which approximately 174 are National Forest property. It is bounded on the north and south by the extent of the Forest, the southern boundary also approximating the course of the Mogollon Rim; the western limits are marked by a more or less arbitrary line that runs south from near the intersection of the 129 Road (Pinedale-Taylor Highway) and the Forest boundary, along the western slope of Juniper Ridge, to the Rim; the Navajo County line serves as the Unit's eastern boundary (see frontispiece).

The Unit, abutting the Mogollon Rim as it does, lies on the edge of the Colorado Plateau. The plateau itself was once part of the bed of an ancient sea that mountain-building forces have lifted bodily to its present elevation (Putnam 1964); this same orogenous activity, centered to the south, has also uptilted the plateau's margin resulting in formation of the Rim. West of Show Low Creek, generally speaking, only erosion by wind and water have altered the topography of the tilted plain, providing the local relief that varies from small, open valleys or hollows to quite rugged ridges separating deep washes. These washes and ridges trend in a north to northeasterly direction. The soils in this portion of the Unit are all derived from sedimentary sources: sandstone, limestone, and Tertiary/Quaternary gravels and cobbles. The distribution of these soils, because of local geologic history and differential erosion, is a heterogeneous, complex collage of microzones that sometimes grade into one another and sometimes change abruptly from ridge to ridge (see Palmer n.d.). This soil assortment will be referred to collectively as Mogollon soils (USDA 1964) with modifying adjectives (sandy, Quaternary, and so on) used where appropriate.

East of Show Low Creek, encompassing perhaps 70 percent of the Planning Unit (see Figure 2), there is a much different geologic story. A long period of volcanic activity has built up mountains and laid down a thick stratum of basalts over this portion of the plateau. The effects of vulcanism intensify from north to south; natural relief near the Rim is provided principally by numerous extinct cinder cones of varying dimensions; the area to the north is primarily a plain of massive lava flows that evidences little major relief and slight, differential amounts of erosion, stream cutting, and soil formation.

Cross-cutting the gross soil zones is a plant community boundary. The Unit contains two major biomes: the juniper-pinyon woodland and the Ponderosa pine forest; these comprise, respectively, approximately 55 percent and 45 percent of the Unit (Figure 2). This biotic boundary is more or less defined by elevation (ca. 6500 feet) which is the major factor in determining rainfall and temperature variations.

Aerial photographs of the area show that a large proportion of the woodland is seemingly a short-grass grassland regime. On-the-ground inspection, however, reveals that the vast majority of the open areas are the result of recent reforestation efforts to increase edible ground cover for cattle. Although some portions of the Unit, especially those nearer the northern boundary, are possibly natural grasslands, their incidence and prehistoric importance seem to be relatively slight; hence, they are of no direct concern here.

Still on the most general level, there is essentially little difference between the two biomes in terms of the types of flora and fauna that were economically important to prehistoric populations (Kearny and Peebles 1951; USDA 1972; summary in Hoffman n.d.). Within the plant communities, however, there is a range of microenvironments, some of which were exploited by prehistoric inhabitants more intensively than others. Soils, topography, and elevation are the important determinants of the incidence and intensity of these microzones. Within the woodland one encounters situations that vary from very open to relatively dense; situations where juniper dominates the canopy, others where pinyon is more common. The forest holds open parkland areas containing little understory, open areas with a great deal of oak, ridgetops where locust and manzanita are predominant, and dense stands exclusively of Ponderosa. Some of the forest's variability, however, is undoubtedly the result of recent logging activities.

Various drainage types provide specialized habitats for certain plants. For instance, subhumid washes are the locus for saltbush communities; in moister situations walnut, grape, willow, and cottonwood thrive along with their riparian associates. In some situations stands of Ponderosa occur below the usual biotic boundary; this is due to temperature inversions created by adjacent drainages. Specialized microzones such as these are known to have been economically important in the past (Dr. Richard I. Ford, University of Michigan, personal communication).

As a final word, it should be noted that different species of fauna have different requirements and preferences in terms of vegetation, topography, and so on; accordingly, the pattern of faunal distribution adds more variety to the kinds of natural zones that have been identified (see USDA 1972:26-30). The great biotic variety has only been hinted at. As with the distribution of the Mogollon soils, the distribution of these microenvironments forms a complex picture within the framework of the woodland/forest dichotomy.

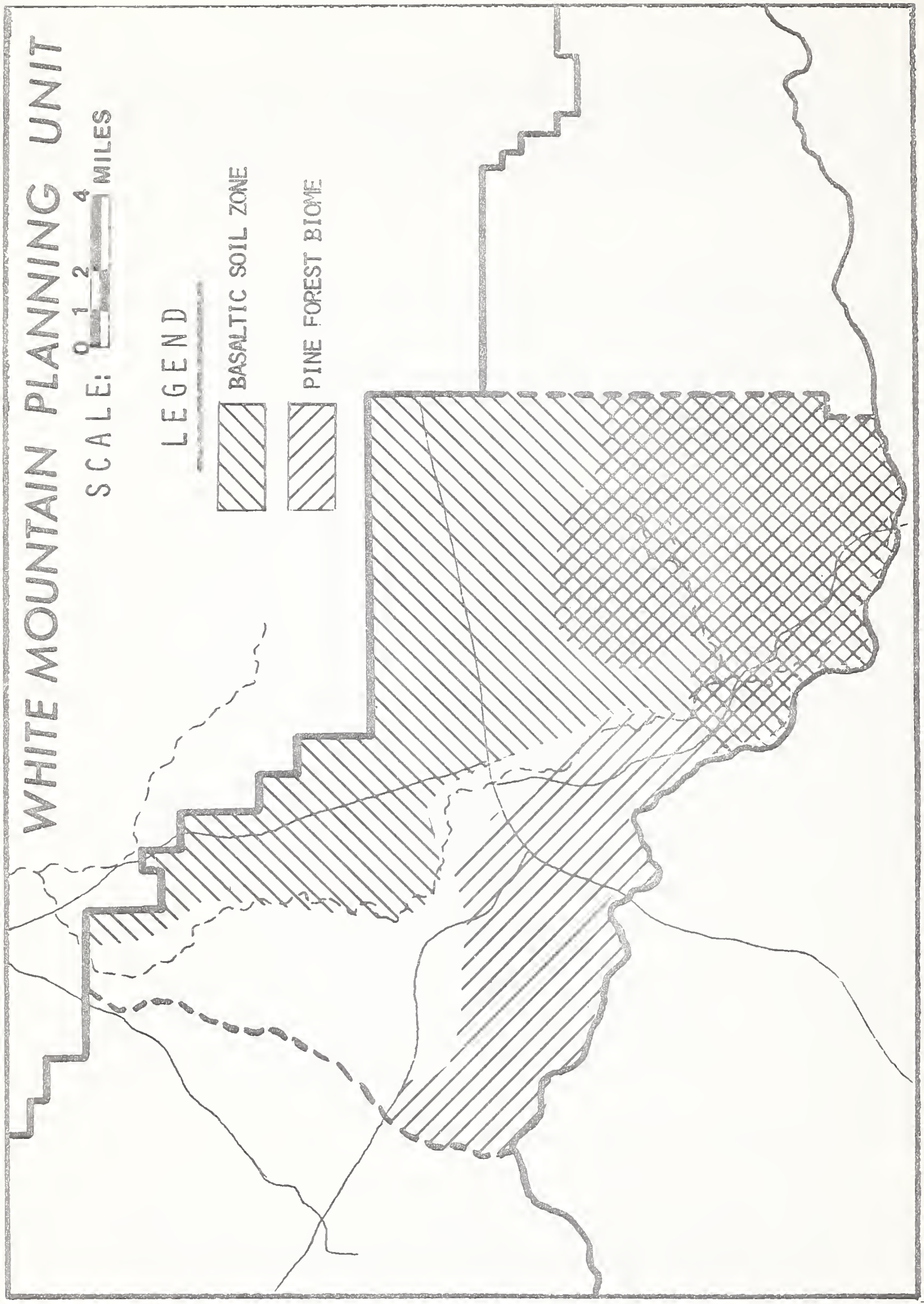

FIGURE 2: Soil and Plant Zones of the Unit. (Mogollon soils occur west of the basalts; the juniper-pinyon woodland lies north of the Ponderosa pine forest.)

RESEARCH DESIGN

Introduction: Survey and Sampling

Archeological survey is undertaken in many ways for many reasons, depending on the problem and on the kind of information being sought (Hole and Heizer 1973:163). Generally speaking, however, these diverse reasons can be classified into four types (Ruppe 1966; cf. also Plog 1974a:69-71 and Mueller 1974:4-6). The first, the extensive reconnaissance type, is used to build up an inventory or catalog of sites over a large area. The second "is the brief survey conducted in conjunction with a specific program of excavation" (Ruppe 1966:315), undertaken in order to supplement the excavation program by broadening the data base, adding coherence and clarity to the analysis. Like the first type, the third is usually extensive in nature but it is problem-oriented in that such a survey would be used, say, to define the spatial boundaries of a particular phase or culture. The fourth and final survey type is intensive in nature, emphasizing the recording and surface-collection of all sites within the survey area; following Plog's interpretation (1974a:70) this also may have a problem orientation in that such intensive collecting "will be useful in understanding the organization/adaptation of the populations that inhabited the sites." Despite the slight degree of overlap among some types, Ruppe's classification serves to distinguish the main reasons archeologists survey.

According to this typology, the survey undertaken for the White Mountain Planning Unit would be considered an extensive reconnaissance made in order to construct an inventory of sites from which a density map could be generated. Yet the manner in which the survey data was recorded was intensive, i.e., all relevant information was extracted. The research design adopted allowed us to sample every portion of the Unit, a tract that encompassed some 226 square miles, for which complete coverage was not possible, nor, as will be seen, necessary. Deviations from this approach were slight and were mentioned under the Tactics subsection above.

Having briefly discussed the different reasons archeologists survey, attention will now be turned to the different approaches used in locating sites. Survey Types Two and Four are intended to provide complete coverage of a relatively small area. Types One and Three, designed for coverage of much larger areas, implicitly require that the survey area be sampled, that is, given usual limitations on time, funds, and personnel, it is not feasible to consider complete survey of an area of more than a few square miles; hence, the investigator must consider covering only a portion of the survey area. "Sampling is a compromise; it is a means of getting an adequate representation of some universe of data without having to deal with all the data in that universe" (Watson, LeBlanc and Redman 1971:121).

Once the need for sampling is recognized, there remains the problem of obtaining an "adequate representation." The first step in this procedure is delimiting the survey area or universe. This universe is then subdivided into units of arbitrary size and configuration, based on various research considerations. For instance, our study simply used the mile-square sections of the township-range systems for the initial sampling units. Sections, of course, are not the only geometric units that could be selected: quarter-sections, square kilometers, rectangles of various dimensions are all possibilities. Natural units--river valleys, plant communities, mesa tops, and so on--have also been used to delimit samples. Determination of unit size and configuration is entirely within the province of the investigator, his decision being based on a number of factors including previous experience, theoretical optima, the nature of the universe, a priori knowledge of the area, and so on. The only qualification is that the units be defined so that measures of comparability may be made among them.

Once the determination of the sample unit is completed, one must decide on the size of the sample or the sample fraction, that is, on what proportion of the universe is to be investigated. Mueller (1974:30) gives examples of studies whose sample fractions ranged from only 1 to 50 percent. Of course, each study cited had a different objective (viz., settlement patterns (50 percent sample fraction), artifact populations (10 percent), subsistence strategies (7 percent), and site frequency (1 percent)), and it was the research objective that, in large measure, determined the sample size.

The final step before operationalization of the research design is deciding on the sampling procedure. Similar to the decision on sample fraction, "the design of a sampling plan . . . hangs largely on the type of distribution being investigated" (Haggett 1965:194). Following Haggett (1965:191-199; see Cochran 1963 for a mathematical treatment, and Redman 1974 and Mueller 1974:30-42 for archeological applications), who has provided a diagrammatic model (reproduced as Figure 3), we see data collection designs fall under three broad categories: complete survey (100 percent "sample"), purposive sampling, and probability sampling. "In purposive or 'hunch' sampling, individuals are selected which are thought to be typical of the population as a whole . . . The validity of the choice depends on the skill of the selector, and is usually open to debate" (Haggett 1965:191). Such sampling has characterized much early archeological field work, the deciding factor usually being site accessibility. Unless the site is obviously atypical, it is assumed to be representative without the use of any objective criteria. Purposive sampling does have its place, but only after sufficient data have been garnered on an objective basis.

"In probability sampling the samples are drawn on the basis of rigorous mathematical theory and, once the design is adopted,

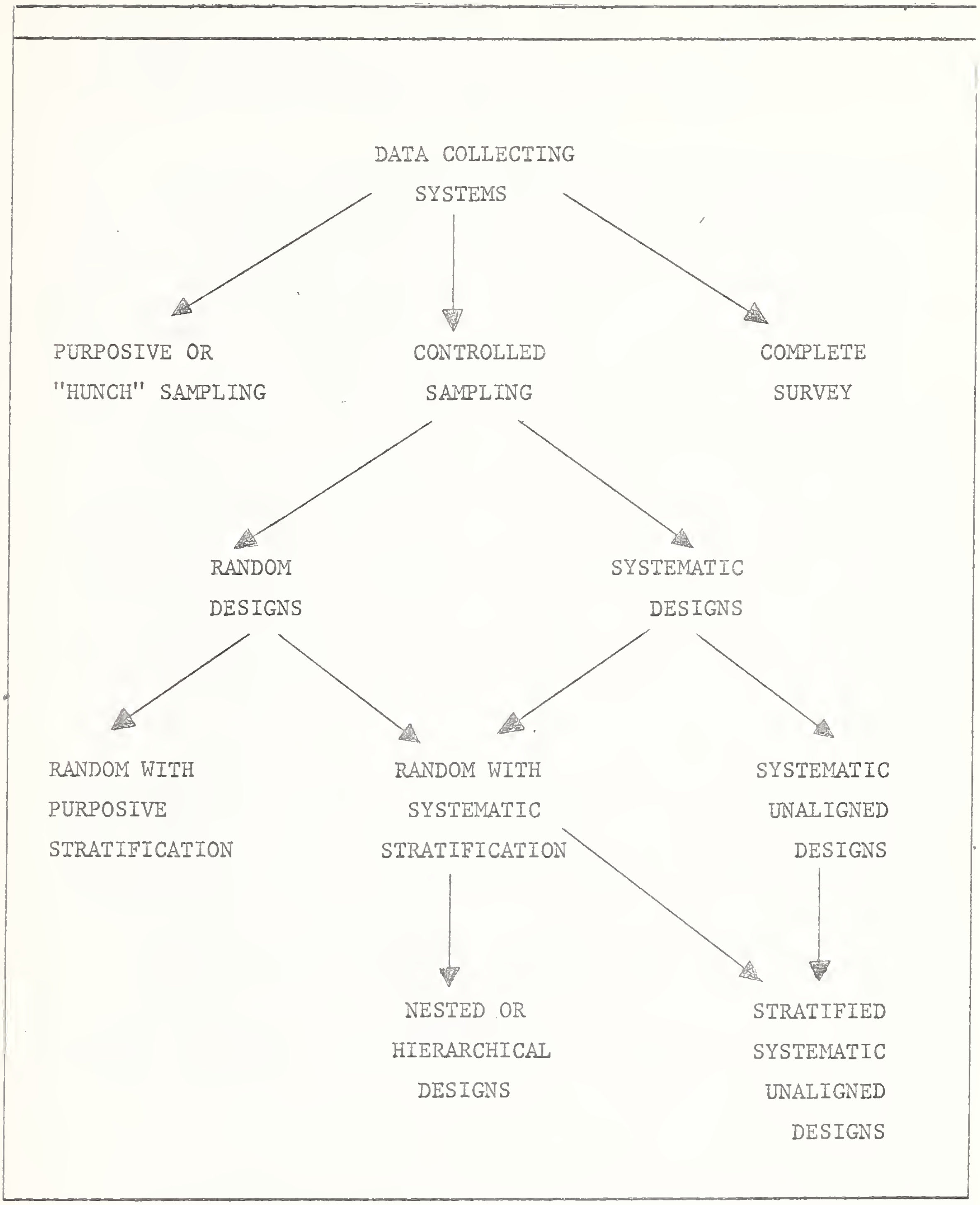

FIGURE 3: A Model of Sampling Designs (Source: Haggett 1965:195)

individuals are drawn from the population by established rules" (Haggett 1965:191). There are several such sampling designs that can be used by archeologists, depending on the problem and the nature of the universe. The basic designs are presented below.

Random Designs. With a simple-random design, each unit has an equal probability of being selected, that probability being equal to the sample fraction. With an areal survey of any extent, this design's main drawback becomes readily apparent: coverage. There is no assurance that a simple-random design will allow the survey universe to be sampled in terms of the extant range of variability; a survey must, in toto, be reliable, so a method must be found to insure that coverage will be as even as possible.

Systematic Designs. A systematically drawn sample is one in which coverage is improved, since all selected units are equidistant. Probability only enters into the selection of the first unit, which is usually done randomly; the selection of each and every unit thereafter is determined by the placement of the first unit and the sampling fraction. The usual procedure is to determine the sample fraction (say, 1/10), randomly select the first unit from among the first 10 percent (say, #6), then systematically select every tenth unit from that point (16, 26, etc.--this is assuming a universe of 100 units). The major drawback to a systematic design is that any periodicities in the phenomena under investigation may bias the results of the sample.

Stratified Designs. With a stratified design the research universe is divided into subareas or segments larger than the sample units and then individual units are selected from each subarea in proportion to the physical or other relevant dimensions of the subareas. If the units are drawn randomly the design is termed a "stratified-random design;" if drawn systematically, a "stratified-systematic design." The main purpose of stratification is to subdivide the universe in such a manner that the subdivisions evidence more homogeneity within them than between them. As stated above, strata can be determined on an arbitrary or natural-area basis (analogous to sample units), "but, in any case, should be related to the research objectives" (Mueller 1974:32) and based on the investigator's a priori knowledge of the universe (Read in press).

The Sample Design

The Planning Unit was stratified on the basis of township, the survey universe encompassing four complete townships and parts of seven others. Within the 36-square-mile township, the square-mile sections were treated as the preliminary sample units. The initial sample fraction was 1/6 or 0.1667, that is, six sections in each township were selected randomly; partial townships included

in the Unit and those containing significant proportions of private property were sampled at the 1/6 level or higher. This preliminary sampling scheme would be classified as a stratified-random design.

The scheme to this point is characterized as "preliminary" because it is but the first level of a compound or hierarchical sampling design. In reality, the section was not our sampling unit--if the section had been treated as a quadrat and surveyed completely using our standard field tactics, we would have been hard pressed to investigate a single township in the available time. Rather, the first-level design selected section midpoints which would become the midpoints of our actual sample unit--the transect. The number of Stage I transects corresponds to the number of selected sections; so, in effect, we sampled our sample.

Orientation of the transects (maintaining the section midpoint as the axis) was randomly determined from four cardinal options: east-west,north-south, northeast-southwest, and northwest-southeast. Keeping the section boundary as the limits of the transect, this procedure generated transects of two lengths, "short" transects of one mile (oriented N-S or E-W) and "long" transects (NE-SW or NW-SE) 1.4 miles in length. Short transects of a 50-yard width covered 2.84 percent of the section; the section-sample fraction of a long transect is 4.26 percent. Theoretical sample fractions for a township, using all possible transect length combinations (and given the initial 1/6 fraction) are listed in the table below.

Sample fractions that range from slightly less than 1/2 of 1 percent to just over 2/3 of 1 percent may seem ineffectually small, but it should be recalled that this phase of the research was designed only to give us a notion of relative site density within the Unit and of site incidence vis-a-vis the natural variables,

TABLE 1: THEORETICAL SAMPLE FRACTIONS

Number of Long Transects	Number of Short Transects	Sample Fraction
6	0	0.006696
5	1	0.006369
4	2	0.006042
3	3	0.005715
2	4	0.005389
1	5	0.005062
0	6	0.004735

thus providing a data base for the planning of Stage II. That such sample fractions are of real utility in this regard is due

in large part to two unrelated factors, factors that while somewhat tangential at this point are nevertheless of import and deserving of explicit comment.

It must be made clear that a survey of the type undertaken does not sample sites; what is being sampled is territory. Our use of the transect is of benefit in this regard. A square quadrat of equivalent area has the same theoretical probability of locating a site, but a quadrat will not sample as much territorial variability--in terms of landforms, plant, and soil microenvironments--because of its shape; this should be intuitively obvious. By sampling relatively more of the range of natural variability, the investigator gains a better understanding of the universe he is studying; insight which helps him better isolate the factors that most probably applied prehistorically in the determination of site location. Thus transects provide more information (although not necessarily more sites) for the same amount of effort; transects may be even less expensive in terms of man-hours because they are easier to locate on the ground and the boundaries are easier to maintain during the course of survey (Plog and Hill 1971). A great amount of effort has been put into the development of sampling theory, and there are indications from the literature on geography (Haggett 1965:199), on ecology (Daubenmire 1968:87-88), and on archeology (S. Plog n.d.:35) that transects may be the more efficient sampling tool. The transect's limitations should be noted as well: through employment of the transect we are able to explicate "variability in site types and in artifacts, but not in settlement patterns, [that is], spatial relations between sites. In other words, the sample was designed to elucidate 'composition' of the archeological record of the region, but not its 'structure'" (Plog 1972:5). Again, it must be reiterated that the nature of the sampling design is dependent on the goals of the research. This report, along with the additional volume of data analysis which is planned, should serve as an example of how a survey of limited intensity (the sample fraction for the Unit, excluding private landholdings, is 0.01706) can adequately elucidate the prehistoric record of a region.

The second factor supporting the utility of the Stage I sample fractions concerns our knowledge and assumptions about human behavior.. Archeology--"the anthropology of the dead"--is considered a social science by most of its practitioners. The discipline's claim to such status is based on our ability to elicit information about past human societies, usually in the absence of contemporaneously written records. The success attained in the delineation of prehistoric behavior is most notable in studies of technological and subsistence practices, settlement and demographic patterns, and trade and kinship systems (see Hole and Heizer 1973 for references). Why have we been successful in such endeavors?

It is because we have assumed that practices, patterns, and systems characterize the behavior of human populations, and these assumptions have been borne out. In short, the actions and reactions of individuals taken in the aggregate are nonrandom, and, given sufficient data, are even predictable. Thus, a prehistoric activity locus is far more than a dot on a map: it is located with respect to a particular landform within a particular habitat, is oriented in a particular direction, contains a unique collection of artifacts, and so on. As these particulars accumulate, a pattern of site location in time and space begins to emerge. Given our extensive a priori knowledge of settlement patterns to the north and west (based on first-hand experience), it required but little effort to estimate how closely the phenomena within the Unit corresponded to our expectations; of course, deviations from the general pattern did occur and were expected (though in an unspecified manner). If the Unit and its environs were terra incognita, the fact that behavior is nonrandom would be of little help. In this case we knew how the patterns were structured, and exploited that knowledge to the fullest. With these comments made, the rationale behind our choice of sampling design can be better understood.

To summarize the rationale behind the decisions in the construction of the research design, we will recapitulate the design itself.

1. Determination of the universe, the White Mountain Planning Unit, was a decision made by Forest Service personnel. As such, it was specified prior to our involvement in the project and extraneous to our research interests to this extent. On the other hand, the Unit is intermediate to areas where investigations of varying intensity have already been undertaken; hence, fills a geographically defined gap in our knowledge.

2. First level sample units, the mile-square sections, were selected because the region including the Unit had been mapped by the U. S. Geological Survey, and most section corners and many quarter corners had been found and marked on the ground; thus, our transect, as well as the sites found, could be located with a high degree of confidence.

3. The first level sampling fraction of 1/6 was arrived at on the basis of experience. We knew that this fraction would provide a suitable preliminary approximation of site densities (see Read in press).

4. Stratification of the Unit on the basis of township was done in order to disperse the randomly selected sample units. Some degree of adequate coverage was thus assured.

5. Rationale for second level sample units and sample fractions has been presented above and will not be repeated. It should be obvious that they resulted directly from decisions made at the first level.

PREHISTORY

In an area such as that encompassed by the Planning Unit, where little previous research has been done, an investigation limited to nonintensive survey can do little more than sketch an outline of the prehistory; as noted above, research methods such as ours do allow the compostion of the prehistoric record to be unveiled, if not its structure. Fortunately, in the area between the towns of Snowflake and Springerville, just north and east of the Unit, some fifteen years of archeological reconnaissance and excavation have been undertaken by Chicago's Field Museum of Natural History under the direction of the late Dr. Paul S. Martin (see Martin et al., 1960a, 1960b, 1961, 1962, 1964, 1967); the results of this work have been synthesized by William A. Longacre (1964) who gives an overview of regional prehistory to which we can compare our own tentative chronology.

The preliminary chronology for the Planning Unit is based on a componential analysis of the ceramic collections. Sherds from painted whiteware vessels were sorted on the basis of three general criteria: surface treatment, paste color/tempering inclusions, and paint composition (see Plog in press). Since mineral paints were used almost exclusively on the ceramics found in the area, and since surface treatment correlates highly with the paste/temper variable, for all practical purposes we only had to deal with four "types" of ceramic; these were polished-with-"gray" temper (PG), polished-with-sand temper (PSa), slipped-with-sherd temper (SSh), and unslipped/unpolished-with-sand (USa). The results of the sorting process were systematically clustered by a Neighborhood Limited Classification Analysis computer program wherein each site is treated as a case with empirically defined proportions of each of the ceramic variables. The program examined the data on a case-by-case basis, clustering those sites evidencing the greatest degree of type-proportion similarity; the clusters which were distinguished exhibit less variability in type-proportions within them than between them. In effect, the program seriated the data, marking divisions between clusters in a nonarbitrary manner (Dwight W. Read, [1974] whose program was used, gives a cogent, more technical account of the program's operation). The seriogram below reflects differences in the ceramic assemblages, the variability being regarded as change over time.

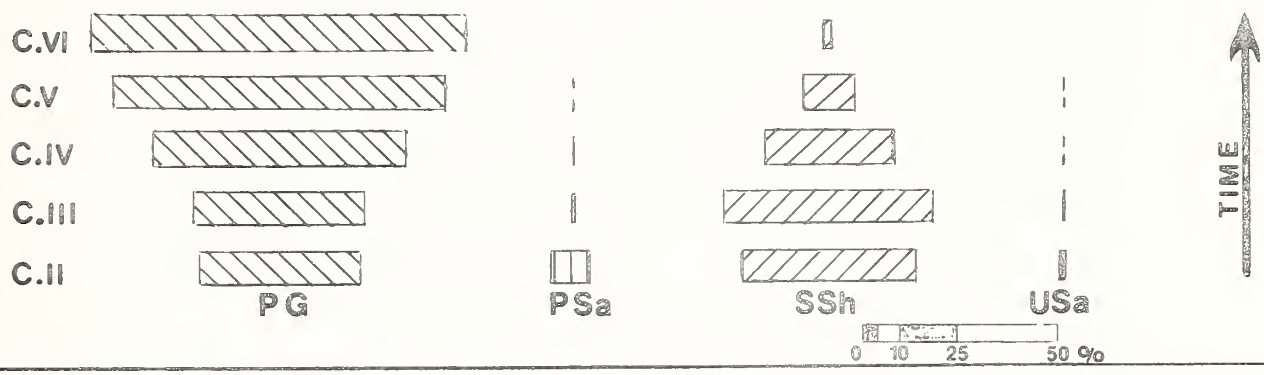

FIGURE 4: Seriogram of the Unit Ceramics.

Such intersite variability in ceramic proportions, however, can be effected by primary causes other than time; these causes include sampling error, functional differences, and spatial dispersion (cf. Freeman and Brown 1964). Data derived from surface collections are subject to a host of factors that contribute to bias in the sample (see, e. g., Schiffer and Rathje 1973). The only practical control available was the special effort made to sample the range of ceramic variability at every site recorded; hence, sampling error can be discounted somewhat by dint of our use of the collection transect. Functional differences can also be discounted: fully 70 percent (49 of the 69 sites with ceramic collections sufficient for analysis) of the sites submitted to cluster analysis are habitation sites, which would indicate that clustering was performed on multi-functional loci; further, it is a reasonable assumption that at least some such functions are basic (serving, storage) and therefore more or less constant in their presence through time. Like sampling error, a host of factors under the rubric of spatial dispersion could account for intersite variability; since the seriation depends upon technological components of the ceramics, the two most obvious factors would be reliance of geographically dispersed populations on qualitatively different raw materials sources and/or on distinct technological processes of fabrication. If either or both of these factors is affecting the clustering operation, then the clusters should evidence between-group spatial dispersion of sites. A brief review of the

transect data does not indicate that such is the case. An examination of the accompanying table generally bears out this conclusion. The sites in the table are divided on the presence/absence of structures and on the probable number of rooms; the division into north and south groups is by biome provenience, north being the woodland area and south the pine forest. The incidence of private landholdings within the Unit boundaries generally coincides with the biome edge, so along with possible implications of differential adaptive strategies, real spatial dispersion of the groups provides a sound basis for making the comparison in this manner. Thus, spatial dispersion of sites, as a factor influencing the clustering operations, can also be discounted. (It is realized that the brief discussion above is not as rigorous as it could be; a more extended discussion--which would be tangential at this point--would lead us to the same conclusions and necessitate the same assumptions. In any case, the factors contributing to uncertainty in the conclusions have only been discounted, not obviated.)

TABLE 2: FUNCTIONAL DISPERSION OF SITES

	Large Habitation	Small Habitation	Limited Activity Site
North	4	15	19
South	11	19	15

(Note: Large habitation sites are defined as having more than five rooms.)

It can therefore be postulated, through this logical process of discounting the impact of extraneous factors, that the resultant clusters largely reflect temporal classes. Such a conclusion is borne out by independent examination of the associated architectural features and of the ceramic samples on the basis of the traditional southwestern typology (see Colton 1955a, 1955b, 1956, 1958); while Cluster VI contains sites with relatively late pottery (e. g., St. Johns Polychrome) and relatively large, planned masonry pueblos, Cluster II consists of sites with early wares (e. g., Lino Gray) associated with pithouses. ("Cluster" I is the arbitrarily defined temporal class containing all preceramic cases.)

Lacking definitive excavated material and independent dendrochronological dates, an assessment of the Unit's prehistory is best made within the context of the Upper Little Colorado region. A synthesis of the regional prehistory has been presented by Longacre (1964), the outline of which is found in the following table. Having argued for the acceptability of the seriation,

we can now conjecture, based on individual site reports, how the site clusters correlate with the various phases delineated by Longacre.

TABLE 3: OUTLINE OF THE REGIONAL PREHISTORY (Source: Longacre 1964)

PHASE	APPROX. DATES	CHARACTERIZATION	SETTLEMENT TYPE	ARTIFACTS
I	1500 BC to ca. AD 300	Food Collectors	Small, impermanent camps; no spatial clustering	Basin metates; chipped-stone tools
II	AD 300 to 500	Incipient Agriculturists	Two to four pithouses with associated storage pits	Mortar & pestle appears
III	AD 500 to 700	Initial Sedentary Farmers	Deeper, larger pithouses; small villages	Trough metates; unpainted pottery appears
IV	AD 700 to 900	Established Village Farming	Large, unplanned pithouse villages	Painted pottery
V	AD 900 to 1100	Beginnings of Planned Towns	Planned and unplanned clusters of surface houses; kivas appear	Textured pottery appears
VI	AD 1100 to 1300	Established Towns - Beginnings of Convergence	Large masonry pueblos; fewer but larger sites	Polychrome pottery estab'd
VII	AD 1300 to 1450	Large Towns-- Full Convergence	Few sites restricted to Little Colorado & Silver Creek Drainages	Late polychromes & glazeware

The arbitrarily defined Cluster I (C.I) encompasses Phases I and II, containing sites of undoubted Desert Culture affiliation and small pithouses with no evident ceramics. C.II corresponds by and large with Phase III. C.III contains two pithouse villages, each with an area approximating 1000m^2, along with smaller loci;

This corresponds to the general description of Phase IV sites. C.IV contains some pithouse sites as well as clusters of unplanned surface structures, hence would most likely represent a late-Phase IV/early-Phase V period. C.V and C.VI contains the majority of the clustered sites, including relatively large, planned pueblos; these sites are seen as extending from late-Phase V into Phase VI. "Large" sites--perhaps associated with Phases VI and VII--located along Show Low Creek have been described to me, but, because these occur on private property and have been destroyed by recent construction, no collections were made and no subjective evaluation was attempted. One documented site, Show Low Ruin, clearly falls into the Phase VI-VII period (Haury and Hargrave 1931) and is located within the boundaries of the Unit, but this may well be the only exception.

Figure 5 is the site-density estimation map. Because our inventory is low relative to the area covered, there would be little point in considering density per temporal class at this stage; thus, the map reflects site densities for all time periods. Estimations were based on sites per transect, with transect midpoints used as data points. This information was read into a SYMAP computer program which generated a contour map of the Unit showing site densities as we defined them; Figure 5 is redrawn from the resultant output map (since no argument can be made for the finite accuracy of the map--the program extrapolates contours to areas from which no data are available--we choose to qualify the figure as indicating estimations of density).

Comparison with Figure 2 (page 8) shows that the areas most heavily settled were in the forest biome or near the woodland-forest ecotone. Part of this patterning is obscured by the incidence of private property (a topic to be discussed more fully in the next section). In terms of density vis-a-vis soil zones, it is apparend that, with the exception of the Porter Mountain area north of Lakeside, the basaltic soils supported little prehistoric activity. We have no good explanation of the seeming anomaly; the settlement pattern is not comparable to that of the Sunset Crater area near Flagstaff, for instance (see Colton 1960).

Attention is directed to that large portion of the Unit which is characterized by low site density: "no sites" is meant to indicate only that no sites were located by transect in the area. We have, however, found evidence of prehistoric activity in this area, most notably in the vicinity of the several natural "sink-hole" lakes. Moreover, Longacre, whose surveys for the Field Museum covered portions of this same area, has located sites here (personal communication). Since these sites and other activity areas seem to indicate utilization of this portion of the Unit by preceramic populations, it is strongly recommended that any land-disturbing projects be preceded by intensive survey. The

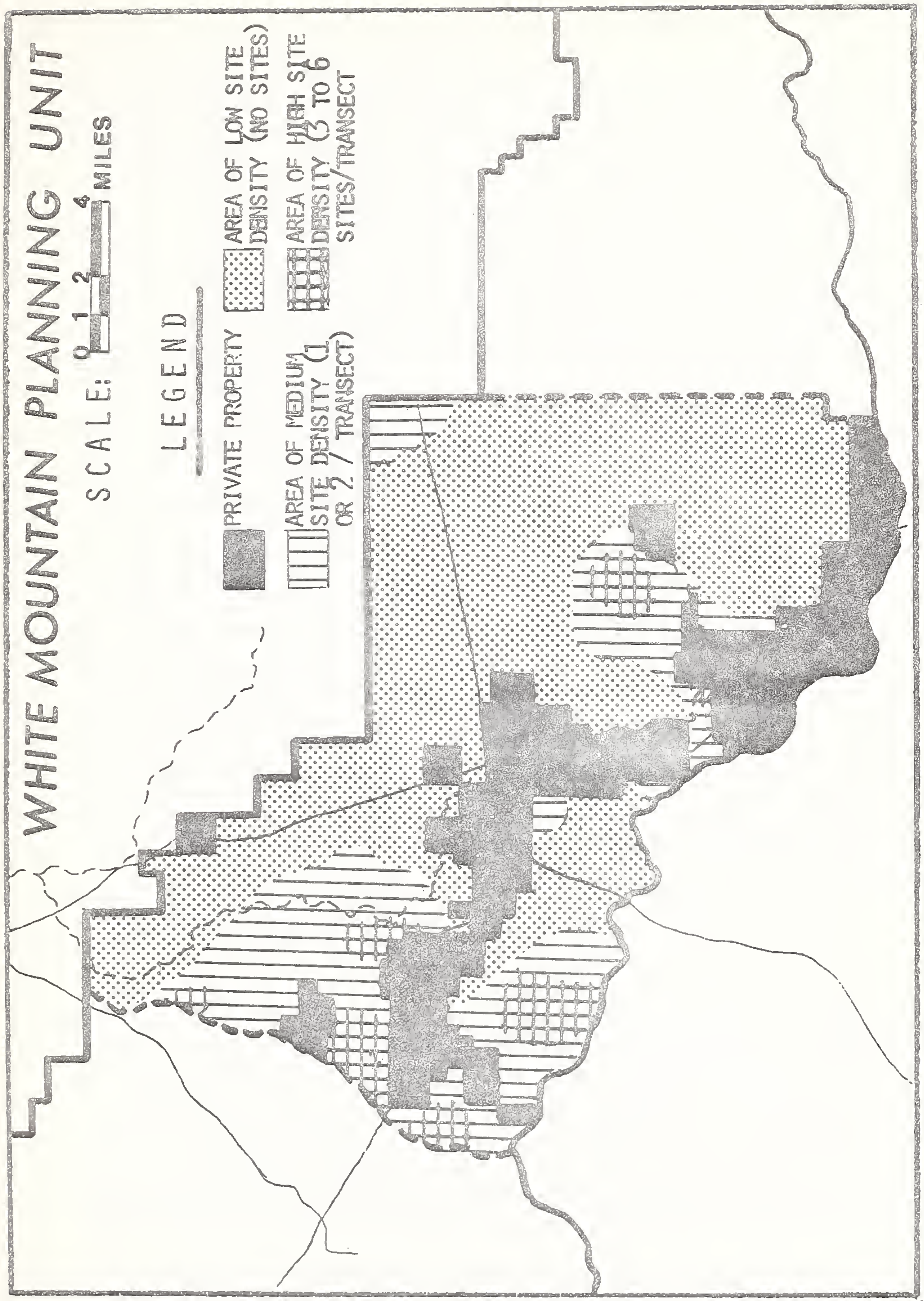

FIGURE 5: Site-density Estimation. (Note that "no sites" in the low-density area indicates no sites found on-transect.)

failure of our survey to locate sites is attributable to the fact that human populations were sparsely distributed during the preceramic millenia so that the location of these activity loci by sample-survey techniques would be an extreme low-probability event. This portion of the prehistoric record is fragmentary at best, and special care must be taken that any manifestations of such early activity on the Unit should not be needlessly impacted.

Within the western Mogollon-soils zone, our site reports reveal that the areas containing sandy soil seem to have been given preference for site location. The soil sample analysis made by Robert Palmer (n.d.), a student who worked on the survey, shows significant differences in clay/sand ratios and carbonate proportions between on-site and random, off-site samples; the full implications of his conclusions are still under investigation, although we can tentatively state that soils capable of best supporting agriculture were a prime site-location determinant.

Generally summarizing our findings, then, it is apparent that, within the Unit, most sites evidencing protracted occupancy are located on easterly facing ridges in the forest biome and adjacent ecotone; the soils in the vicinity are usually sandy, containing a high proportion of carbonates. Microzones with soils derived from basalt, limestone, or Quaternary gravels were usually not utilized as habitation loci. While habitation sites do occur within the woodland proper, their size and incidence is not comparable to, say, the patterns of the Chevelon drainage to the west (at least part of the differences being explained by climatic variations between the two areas). In conclusion, site location vis-a-vis landform, soils, and site-orientation are very similar to the Chevelon and Upper Little Colorado areas; though the respective adaptations to plant communities appear to be quite distinct.

ARCHEOLOGICAL RESOURCES OF THE PLANNING UNIT: AN IMPACT STATEMENT

As one of our contractual obligations, we were to investigate the impact differentials of contemporary population density on archeological resources in separate portions of the Apache-Sitgreaves National Forest. The first part of the following discussion will focus on private landownership within the Unit; the latter part will concern itself more explicitly with a comparison of site destruction between the Unit and an area to the west on the Chevelon and Heber Ranger Districts. Recommendations will be presented as to how the destructive impact could possibly be mitigated.

Of the total area of the Planning Unit, privately owned land makes up approximately 23 percent (52 of 226 square miles). This

land is concentrated along Highways 260 and 173 in and about the towns of Show Low, Lakeside, and Pinetop with a substantial proportion devoted to ranching and farmland west of Show Low. Patricia E. Rubertone, a colleague who also worked on the Unit survey, has found a substantial difference between the mean number of sites per random transect when the transects are divided into classes that distinquish between those transects adjacent to private property and those that are nonadjacent. While nonadjacent transects located 1.0 sites on the average, adjacent transects located 1.4 sites. This 40 percent increase probably is best explained by a congruence of choice for both prehistoric and historic populations; that is, 600 years have not altered the location of the most productive farmland, and both prehistoric peoples and nineteenth century homesteaders selected similar sites for raising substantially similar crops. Today, the distribution of private property within the Forest reflects the choices of settlers of a century ago. A substantial proportion of the area's prehistoric record undoubtedly lies on the other side of private fences.

We had originally intended to illustrate the contrast between site destruction on the Planning Unit and the Chevelon drainage to the west with statistical tables. The magnitude of difference proved, however, not to be one of statistical nuance but of several orders of magnitude; the contrast is stark. A few sites in the Chevelon area evidence minor damage, usually no more than a couple of "potholes;" fewer still have seen widespread damage. On the Planning Unit, however, few of those larger sites having structures have been left untouched; some have suffered damage to such an extent that the probability of recovering information of scientific value has been drastically reduced. The reasons for this contrast are readily apparent and can be considered under two broad categories: "unintentional" damage resulting from normal Forest Service operations, and "intentional" damage resulting from the activities of vandals and pothunters.

Unintentional damage results as a byproduct of natural resource exploitation. Juniper-push operations (done in order to increase forage in the woodland range areas) have been much more intensive on the Planning Unit, hence many more sites there evidence bulldozer damage. Similar destruction occurs because of timber harvesting, but the contrast in this instance is due almost entirely to prehistoric settlement patterns rather than lumbering per se: very few sites are located in the pine forest community of Chevelon (Read in press), while more than one-half of the sites found by survey occur in the forested portion of the Unit.

The impact, unintentional as it has been, of such operations on archeological resources is immeasurable; its incidence without attempt at mitigation, at whatever relative level, is unacceptable.

It is incumbent on the Forest Service, as a Federal agency, to preserve and protect such resources, to mitigate the impact no matter what the economic or ecological benefits that otherwise derive from these operations. The mandate for such agency responsibilities culminated in the Archeological Conservation Act of 1974; included in this broad-based mandate are some half-dozen complementary laws, several additions to the Code of Federal Regulations, and Executive Order 11593 (synopses of relevant legislation are to be found in McGimsey 1972 and in Lipe and Lindsay 1974).

Before enactment of the Archeological Conservation Act (P.L. 93-291), however, there were severe limitations on what the Forest Service could do to discharge its responsibilities. These limitations involved the funding of qualified survey and conservation efforts on areas designated for timbering and range-improvement operations; at best, only those sites already known to the individual Range or Timber Officer would be protected. This situation has been greatly altered by P. L. 93-291, since it expands the application of the Reservoir Salvage Act of 1960 to include all "Federally licensed or assisted projects where significant (cultural) values are discovered or are believed to exist" and such projects "result in a substantial alteration of the terrain" (Legislative History, P. L. 93-291, pp. 1213-1214). The Act provides for procedures to fund the mandated survey and operations to conserve archeological data.

How will compliance with the recent laws affect operations within the Apache-Sitgreaves National Forest? With appropriate planning and timely survey, consideration of the archeological resources should not adversely interfere. The actual onset of timbering or juniper-push programs would be postponed somewhat, but advance planning will obviate any major delays. Excavation of sites potentially endangered is expensive and time-consuming, but under the situations being discussed usually would be unnecessary. Sites could be protected by the simple expedient of flagging off the area surrounding a site for an additional radius of 20-25 yards to warn off heavy equipment. There are limited instances where flagging is already being done, but the responsibilities in this regard have been construed to include (1) only sites with visible structures, and (2) only that portion of a site containing structures; this is not full compliance with Federal laws and policies. The conservation laws make no distinction between sites with structures and any other kind of site, and only rarely is the extent of scientifically valuable and recoverable data limited to the structures themselves. The commitment of the Forest Service and of its personnel to conservation practices is abundantly clear, both in regard to selection of timber stands in the forest and to contour landscaping in the woodland pushed areas. It would take very little extra effort to include the majority of sites within these small preserves. Therefore, because of the relatively confined nature of most sites and site-complexes in the area surveyed, very little additional range or timber

acreage would be removed from production; the economic impact of foregoing this acreage would be minimal, and the returns from the conservation of the cultural resources would be at a maximum.

Intentional damage is that caused by vandals and, more commonly, pothunters. The sites located on the Unit are more prone to such damage because the immediate vicinity has a higher population density than the areas to the west. Complementary and additional factors affecting the differential impact include a greater percentage of private property within the Forest boundaries, more summer visitors, and easier access in terms of roads of all classifications on the Unit than in the neighboring Ranger Districts. Forest Service policies which encourage economic and recreational use of these public lands thus result in indirect impacts on the archeological resources.

Vandalism, in the common use of the term ("malicious or ignorant destruction"), is not a real source of concern in this area at present. If the meaning were to include damage caused by off-road vehicles, however, then there can be seen an ever-increasing amount of harm being done, not only to sites but to the total forest environment. To counter this development, I would suggest that the Forest Service formulate and enforce policy limiting the use of such vehicles to existing roads and trails; such a policy would protect both natural and cultural resources.

Pothunting or collecting primarily covers two groups of people: hobbyists and collectors-for-profit. Members of this latter group--who are not differentiated from vandals by many--will loot a site with the sole intent of selling their finds, usually to a dealer ("trading posts," second-hand and antique stores, etc.) who in turn sells them to private collectors or on the open market. Antiquities dealing is a pervasive world-wide problem, and not confined only to Arizona. The legal sanctions that can be applied in this country are only enforceable when it can be shown that the material was collected on protected property. Without this fact established, there can be no legal case. A dealer, for instance, can claim that his inventory was taken from private (unprotected) property, and that he thus has a legal right to hold and sell the artifacts; such a claim can rarely be refuted for it would be difficult, if not impossible, to prove that a particular artifact came from a particular site or locality unless the looter had been caught in the act. Such problems will continue because of the American ideal (based on English common law) of the sanctity of private property. Charles McGimsey (1972:46-49) more fully discusses the thorny problem of conflict between private property rights and public weal.

Stricter enforcement of the existing law is impracticable if not impossible; the requirements in terms of manpower and man-hours for patrolling sites on public property would be astronomical. Our survey of the Apache-Sitgreaves National Forest, between Show

Low and Chevelon Creeks, has located roughly 1100 sites--and this is but a sample. That there are so many sites is a fact. But that number is nevertheless finite, and, furthermore, each site is unique. Unwarranted destruction means information irretrievably lost. The impact of such illicit activities must be mitigated in some fashion. In terms of curtailing the vandals and looters, I can think of no pragmatic program which would have any real effect; for instance, I do not think that efforts to reduce the market demand for artifacts through public education would be successful, nor do I feel that legal proscriptions of antiquities dealing would be workable.

The same legal conundrum and the same problem of practicality are posed in regard to the second group of collectors, the hobbyists or avocationalists. There may even be additional problems. McGimsey (1972:64) reports that an early version of a state antiquities-protection law was vetoed because the governor refused to interfere with people's private hobbies. Nevertheless, "the public has a right to the historical and scientific information contained in archeological sites, and, therefore, no individual has the right to act in a manner such that this public information is needlessly destroyed" (McGimsey 1972:47). Such cultural resources are part of our national heritage; they belong to us all and should be used to benefit as many people as possible. It matters not that, for most of us, the people who built these structures, made these tools and ornaments are not our direct ancestors; the point is that we choose to live and work in the same areas in which people chose to live and work centuries ago--as they adapted to the environment and adapted it to themselves, so must we. They were here before us and have been here longer. Without a doubt, these former lifeways have something to teach us. It is the role of archeologists to unravel the clues that have been left. It should be the goal of us all to learn. As William Faulkner is credited with having so aptly stated, "The past is not dead; it is not even past."

The motives of the avocationalists can be distinguished from those of the group first considered. A hobbyist obtains artifacts in order to build his collection for his personal enjoyment and for that of his friends; financial gain is not usually a consideration. It is this group of people with which professional archeologists share a common bond, one of genuine interest in prehistory. The differences arise from the viewpoint taken in regard to methods of excavation and to artifacts. Most collectors see an artifact as important for its own sake: a whole pot is better than a broken pot is better than a sherd. Archeologists certainly value esthetic distinctions, but what is of primary importance is the information that can be elicited from the artifact. Since an artifact rarely carries much data itself, we must look to the context of the artifact, where it occurs and what it lies in association with, in order to increase our knowledge. Uncontrolled--that is,

nonscientific--excavation destroys the context completely. A shovelfull of earth can never be put back the way it was before excavation. Irresponsible digging of a site may recover artifacts, but most of the information and knowledge that accompanies them is lost forever.

The above point on uncontrolled digging can be expanded; even controlled excavation loses information, too. Archeology is a science that must destroy in order to progress. This is a fact of which archeologists are acutely aware and which underlies the stress in this section on the need for site conservation. Before a site is excavated the investigator must ask, "Why has this particular site been selected?" The answers to that question are to be found in his previous research, his present research design, and will guide his activities in the future. Excavation for its own sake is not one of the answers, however. As mentioned, no excavation recovers all possible bits of data; in each case a considered judgement must be made as to what needs to be retrieved and what sacrificed, and often the former entails the latter. In many instances, what is being sacrificed is done so unknowingly; new techniques, new applications of old techniques are being developed continuously. Wholesale excavation provides no real solution to the extant problems being considered; no demand is being made for funds to undertake wholesale excavation. "Conservation" is not a limited concept that applies only to saving sites so that I may dig them. There are archeologists yet unborn who need these sites, these primary data sets, to answer questions as yet unasked, utilizing techniques as yet undeveloped.

To sum up this section then, it can be seen that our goals are twofold: first, the preservation of as many sites as possible; second, where sites must be excavated, this is to be done on a planned, controlled basis with the further proviso that as many people as possible benefit from such work (for instance, through publication of the results). These goals have a general application for our entire country. The recommendations I will proceed to make will be in terms of the White Mountain Planning Unit, but, particulars aside, these too will have a wider applicability.

Open-air Museums. While the Planning Unit--and the Forest in general--lacks the spectacular sites of a Chaco Canyon or Mesa Verde, it does contain a range of sites that covers a major portion of southwestern prehistory and that occur in diverse ecological settings. Without being more specific, I could recommend a number of sites that would encompass the range of temporal and environmental variability and that are readily accessible via existing roads. If these sites were excavated and stabilized, they could be included as stopping points on a five-or six-hour auto tour that would provide local residents and visitors insight into the area's prehistory (stops at historic sites and points of scenic and geological interest adding significantly to such a tour). An informative brochure that included a map would allow tourists to make the circuit at their own pace. A well-designed open-air museum would not only provide the obvious recreational

benefits but would allow for an ongoing program in educating the public to the need for site conservation, as well as to the wide range of beneficial services for which the Forest Service is responsible.

Forest Archeologist. At present there exists a professional archeologist's position at the Regional level, but his responsibility covers a broad geographical area and he has but a small staff to aid him. A professional archeologist at the Forest level could have a wide range of duties that would justify the creation of such a post, including relieving the Regional Archeologist of many local responsibilities, overseeing survey and salvage work in areas designated for logging, range-improvement, or other terrain-altering projects, and acting as a catalyst in the formation of local amateur archeological associations. (Such a role would only be necessary in those areas, like eastern Arizona, that have a fairly high population density but generally lack institutions of higher learning; hence, professional archeologists in the private sector.)

Adding an additional level to any bureaucracy has its advantages and disadvantages. The first two functions that I mentioned above perhaps could be filled with additional personnel at the Regional level (either new positions or staff enlargement must take place: the recent passage of the Archeological Conservation Act places many additional responsibilities on the Regional Archeologist and his staff). In any case it is this third function with which I am most concerned, for it is through public education that I see the best possibilities of meeting the goals described above.

It is obvious, from conversations with various individuals and from viewing private collections, that a great deal of time and energy has been expended by avocationalists digging into prehistory. It is equally obvious, from our survey, that sites on public, "protected" property have received a great deal of the impact of such activity. Most, if not all, of the individuals who may be participating in pothunting on Forest Service property are aware of the activity's illegality; the law, however, seemingly has little deterrent force. The sheer impracticability of law enforcement efforts has been discussed. With the given situation, I feel that it would be more pragmatic--and culturally profitable--to organize the hobbyists and channel their energies along lines that benefit the public weal.

A local amateur association, with a Forest Archeologist acting in an advisory capacity, could function as an educational tool. Proper techniques in excavation, recording, and analysis could be learned. The Forest Archeologist could use his expertise to help the group define a generalized research design, enabling

future excavation to be undertaken with specific goals in mind; further, he could use his professional position to generate funds to publish the results of the association's activities. If successful, such efforts would meet the proposed second goal admirably.

A question now arises as to whether, by organizing the activities of the local avocationalists to meet the standards of the second goal, the first goal--that of site conservation--becomes unnecessary or ineffective. I would argue that this is not the case. First, I think that it can be taken for granted that sites will continue to be excavated by private individuals in any case. Second, it should be recalled that there are literally hundreds of sites in the area and that there are indications that a high proportion of these sites are to be found on private property. Third, many of these sites have been disturbed or destroyed in the recent past because of such activities as ranching or quarrying operations and the subdivision of large areas into vacation or retirement properties. In short, there is a demonstrable need for "salvage" operations in areas where Federal laws do not apply. A local archeological association could meet these needs. Presumably the friends and neighbors of association members would cooperate when made aware of the needs and goals of archeology as a science and of the public benefit to be derived from such cooperation.

The organization of a local association would provide the basis for concentrating interest and energy, for dessiminating information and knowledge, and for devising programmatic guidelines to uncover the area's prehistory. The organization of such an association demands a catalyst, a professional; in eastern Arizona only the Forest Service could provide such an individual.

Whereas a law can create explicit, additional responsibilities for an agency such as the Forest Service, it can also delimit what legal compliance entails. The role of amateur-archeologist organizer is not one that our legislators envisioned. The responsibilities of such an organizer are those of personal and professional interest. I feel that the capable Forest Service personnel would not be remiss in assuming such responsibilities despite the overlap into the private sector. In order to preserve and protect our prehistoric heritage it is necessary that public interest and cooperation be engendered. After all, it is individual collectors who now pose the greatest threat to the goal of site conservation. The development of open-air museums and local amateur archeologist associations can only increase public awareness which, in turn, can lessen the impact of private collectors on public resources. Taken in conjunction with the recommendations for mitigating unintentional damage, the prehistoric cultural resources can be managed as efficiently and effectively as our natural resources.

CONCLUSION

"Archeologists hold archeological reconnaissance or survey in high esteem. It has many values and uses. . . ." (Martin 1964: 221). In this report I have attempted to touch on relatively few of the "values and uses" that have resulted from the project. As of this writing, several students are involved in analyses of the data and collections; plans have been made to involve even more students in the near future. Most of the research is focused on our programmatic, long-term goals; that is, ceramic design-element analysis, man-land relationships, and demography. The Forest Service has funded much more than a report on a survey; perhaps it would be better stated to say that the agency simply has made all of this possible. It is in the nature of our discipline to take the same set of data and evaluate it in many different ways; conclusions, even if qualified as tentative or preliminary, engender more questions and further analysis. We hope to provide the results of these analyses in a future volume.

As stated at the outset, this report was intended to serve two purposes. Those questions that the staff of the Planning Unit study were interested in have been dealt with explicitly. Secondly, in addition to those interests in "what," I have attempted to delineate the "how" and "why" aspects of the project. This second purpose is not secondary; I feel that such information is necessary to understand and properly evaluate the conclusions and content of this report. In other words, conclusions alone do not provide sufficient information, for, after all, the conclusions drawn here may not be the best or the most suitable. For instance, the discussion of impact on archeological resources assumes that higher population density in large measure accounts for the higher degree of impact on sites within the Planning Unit; if the contrast with the Chevelon drainage were not so stark, such a hypothesis would have to be tested, say, with comparative census data and with comparative figures on recreational and economic use for the two areas. Our other major focus on prehistoric site density assumes that the density variations can be explained on the basis of the same factors that seem best to account for variability in nearby areas; such a comparison seems reasonable because of the many similarities. However, when we look at the factors that show a noncongruence with the adjacent areas--most notably site concentration in the forest community vis-a-vis such concentrations in woodland or savanna regimes--we can only say that we lack sufficient evidence for the Unit to say more than there are some striking differences. But the similarities do loom large, hence the confidence in the preliminary conclusions we have drawn.

The confidence alluded to is fundamentally based on the first stage of our research design. By delineating a strategy that is

scientifically objective, by making every effort to eliminate bias, we have produced a study in which the confidence is only limited by the time and number of personnel involved in the effort. Such constraints operate in any investigative endeavor, however. The past decade has witnessed a dramatic increase in the conscious application of the scientific method within the archeological discipline. It is this application, even given certain constraints, that assures the validity of what has here been reported.

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